

CLAIMS

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1. A pancreatic controller, comprising:
a glucose sensor, for sensing a level of glucose or insulin in a body serum;
at least one electrode, for electrifying an insulin producing cell or group of cells;
a power source for electrifying said at least one electrode with a pulse that does not initiate an action potential in said cell and has an effect of increasing insulin secretion; and
a controller which receives the sensed level and controls said power source to electrify said at least one electrode to have a desired effect on said level.
 2. Apparatus according to claim 1, wherein said insulin producing cell is contiguous with a pancreas and wherein said electrode is adapted for being placed adjacent said pancreas.
 3. Apparatus according to claim 1 or claim 2, wherein said controller comprises a casing suitable for long term implantation inside the body.
 4. Apparatus according to any of claims 1-3, wherein said electrode is adapted for long term contact with bile fluids.
 5. Apparatus according to any of claims 1-4, comprising an electrical activity sensor for sensing electrical activity of said cell and wherein said power source electrifies said electrode at a frequency higher than a sensed depolarization frequency of said cell, thereby causing said cell to depolarize at the higher frequency.
 6. Apparatus according to any of claims 1-5, wherein said pulse is designed to extend a plateau duration of an action potential of said cell, thereby allowing more calcium inflow into the cell.
 7. Apparatus according to claim 1, wherein said pulse is designed to reduce an action potential frequency of said cell, while not reducing insulin secretion from said cell.
 8. Apparatus according to claim 1, wherein said pulse is designed to extend a duration of a burst activity of said cell.

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9. Apparatus according to claim 1, wherein said pulse has an amplitude sufficient to recruit non-participating insulin secreting cells of said group of cells.

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10. Apparatus according to any of claims 1-9, comprising at least a second electrode adjacent for electrifying a second cell or group of insulin secreting cells, wherein said controller electrifies said second electrode with a second pulse different from said first electrode.

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11. Apparatus according to claim 10, wherein said second pulse is designed to suppress insulin secretion.

12. Apparatus according to claim 11, wherein said controller is programmed to electrify said second electrode at a later time to forcefully secrete said insulin whose secretion is suppressed earlier.

13. Apparatus according to claim 11, wherein said second pulse is designed to hyperpolarize said second cells.

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14. Apparatus according to any of claims 1-13, wherein said controller electrifies said at least one electrode with a pacing pulse having a sufficient amplitude to force a significant portion of said cells to depolarize, thus aligning the cells' action potentials with respect to the non-excitatory pulse electrification.

25 15. Apparatus according to any of claims 1-14, wherein said controller synchronizes the electrification of said electrode to a burst activity of said cell.

16. Apparatus according to any of claims 1-14, wherein said controller synchronizes the electrification of said electrode to an individual action potential of said cell.

30 17. Apparatus according to any of claims 1-14, wherein said controller does not synchronize the electrification of said electrode to electrical activity of said cell.

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18. Apparatus according to any of claims 1-16, wherein said controller does not apply said pulse at every action potential of said cell.

5 19. Apparatus according to any of claims 1-16, wherein said controller does not apply said pulse at every burst activity of said cell.

20. Apparatus according to any of claims 1-19, wherein said pulse has a duration of less than a single action potential of said cell.

10 21. Apparatus according to claim 20, wherein said pulse has a duration of less than a plateau duration of said cell.

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15 22. Apparatus according to any of claims 1-19, wherein said pulse has a duration of longer than a single action potential of said cell.

23. Apparatus according to any of claims 1-19, wherein said pulse has a duration of longer than a burst activity duration of said cell.

20 24. Apparatus according to any of claims 1-23, wherein said controller determines said electrification in response to a pharmaceutical treatment applied to the cell.

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25 25. Apparatus according to claim 24, wherein said pharmaceutical treatment comprises a pancreatic treatment.

26. Apparatus according to claim 24 or claim 25, wherein said controller applies said pulse to counteract adverse effects of said pharmaceutical treatment.

27. Apparatus according to claim 24 or claim 25, wherein said controller applies said pulse to synergistically interact with said pharmaceutical treatment.

30 28. Apparatus according to claim 24 or claim 25, wherein said controller applies said pulse to counteract adverse effects of pacing stimulation of said cell.

29. Apparatus according to any of claims 1-28, comprising an alert generator.

30. Apparatus according to claim 29, wherein said controller activates said alert generator if said glucose level is below a threshold.

5 31. Apparatus according to claim 29, wherein said controller activates said alert generator if said glucose level is above a threshold.

10 32. A method of controlling insulin secretion, comprising:
providing an electrode to at least a part of a pancreas;
applying a non-excitatory pulse to the at least part of a pancreas, which pulse increases secretion of insulin.

15 33. A method according to claim 32, comprising applying an excitatory pulse in association with said non-excitatory pulse.

34. A method according to claim 32, comprising applying a secretion reducing non-excitatory in association with said non-excitatory pulse.

20 35. A method according to any of claims 32-34, comprising applying a plurality of pulses in a sequence designed to achieve a desired effect on said at least a part of a pancreas.